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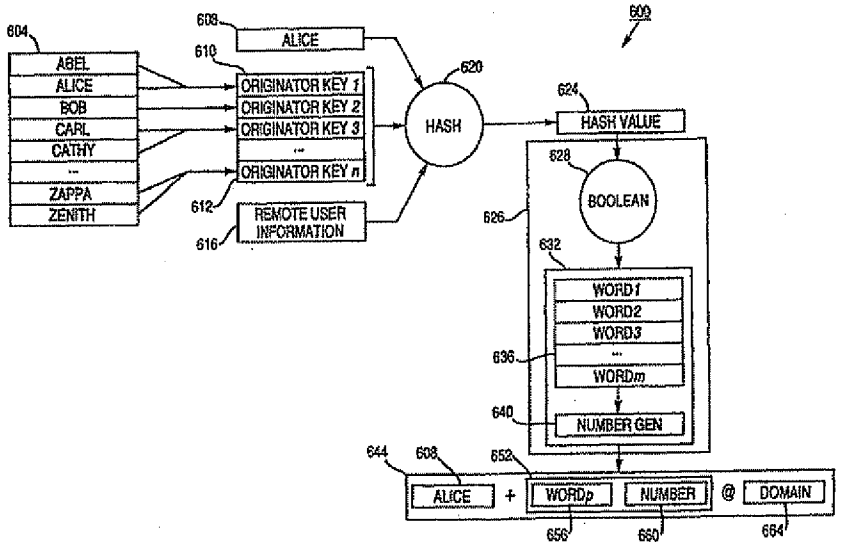


(57) Abstract

A method and apparatus for an authenticated electronic userid (644) comprising an adapted digital signature (652) is provided. According to an aspect of the invention, the adapted digital signature (652) is generated using a secure hash function (620). In one embodiment, the result of the secure hash function (624) is further modified by selecting a word (656) from a word list (632) that corresponds to a value produced by the secure hash function (620). Inbound electronic messages are analyzed to verify that they comprise an authenticated electronic userid (644) having valid adapted digital signature (652). The verification involves re-computing the adapted digital signature (652) using remote user information (616) and an originator key (610).

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# DESCRIPTION

## Apparatus And Method For An Authenticated Electronic Userid

### Field of the Invention

The present invention relates electronic user identification, and more specifically, to an apparatus and method for creating and verifying an authenticated electronic userid.

### Background

Electronic mail, or "e-mail" has become one of the most popular forms of point-to-point communication for people with access to the Internet. An e-mail system typically comprises a database server, a local area network (LAN) and/or a modem bank, and an internet gateway. A user, who communicates with others via e-mail, is typically given a user identification, or "userid", that permanently and uniquely identifies that user with the database server. The server typically has its own identity too, for example, the server is sometimes referred to as a host and the identity is called a "host name", or in some circles a "domain name." When a user desires to check their e-mail, the user logs onto the e-mail system and e-mail messages are displayed on a terminal device or personal computer. A great advantage of e-mail over traditional mail which accounts, in part, for its surge in popularity, is that messages can be delivered significantly faster, messages can be easily distributed to significantly more recipients, and it is, generally, less expensive for the user than regular mail, or "snail mail."

Junk e-mail or unsolicited bulk e-mail ("UBE"), referred to hereafter as "spam", has become a significant problem. Users of electronic messaging applications are barraged with spam on a daily basis by spammers (those who create and send spam). Spammers usually advertise sham wares, services, pyramid schemes, and, even worse, they send electronic viruses.

Spam has grown in popularity for a number of reasons. Primarily, it is a low cost and fast medium through which messages can be delivered. Further, the ease with which a spammer can harvest e-mail addresses, for example, from joke lists, newsgroups, web pages and cookies, provides a steadily expanding audience to which spam can be directed.

Filters have been proposed and a few developed that attempt to reduce or eliminate spam from a user's mail host and/or e-mail client.

One type of spam filter is a sender filter. The sender filter rejects all messages from an untrusted source, such as by way of an authorized or an unauthorized sender list. Inbound e-mail messages are simply rejected based upon the source of the message (e.g.,

the "from:" address of a message header). A major problem with the sender filter is that the sender's identity is frequently spoofed as either a random sender (which bypasses the unauthorized sender list) or as a sender unlikely to be rejected (which bypasses the authorized sender list.)

Another example of a spam filter is a context filter. A context filter examines a message body or a message subject header and removes messages based upon key words or phrases a spammer is likely to include in the message (e.g., "get rich", "work from home", "call now", "porn", "xxx", etc.) A problem with context filters is that linguistic rules must be set up for a particular user in a particular environment. Moreover, language or context alone is inherently imprecise. Thus, context type filters generally suffer from an over-inclusiveness problem -- meaning they filter more messages than they should because legitimate messages occasionally match the linguistic rules of the context filter.

Still another approach is the use of traditional encryption/decryption technology. Traditional encryption/decryption technology includes the use of shared encryption/decryption algorithms or keys (e.g., asymmetric or symmetric encryption). For example, in an asymmetric encryption/decryption system, a sender encrypts a message body using the intended recipient's public key. The recipient receives the encrypted message and decrypts it using her private key. A problem with this technique is that special equipment is required by both the sender and receiver -- such as proprietary software or hardware. In a symmetric encryption solution, a secret key is shared between the sender and recipient. A problem here is that the shared key can easily be compromised. Moreover, encryption/decryption solutions can be computationally expensive and difficult to manage as compared to the low value of most e-mail messages. Some encryption/decryption solutions even require multiple handshaking and/or a real-time connection between the sender and receiver.

Thus, there is a need for a unique method and apparatus for authenticating electronic messages that is capable of controlling UBE and other forms of electronic messages that clutter communication applications such as electronic mail. Moreover, there is a need for a secure and trusted technique for identifying and filtering unauthorized electronic messages.

Summary of the Inventions

An apparatus and method for creating and verifying an authenticated electronic userid is provided. According to one embodiment, an electronic message system generates an authenticated electronic userid for a local user that comprises an adapted digital signature. The adapted digital signature, with other identifiers, provides temporary or restricted electronic message privileges to a remote user.

According to one embodiment, the adapted digital signature grants privileges to a particular remote user for access to a single local user on the message system. However, according to another embodiment, the adapted digital signature grants privileges to a number of remote users from a particular host for access to one or more local users on the message system.

In one embodiment, a process for creating an authenticated electronic userid comprises the acts of generating an adapted digital signature based on an originator key and a portion of a remote userid, and concatenating the adapted digital signature with originator information to form the authenticated electronic userid.

In another embodiment, a process for authenticating an adapted digital signature comprises the acts of extracting a local userid and remote user information from an incoming electronic message; comparing the local userid to a list of local users; verifying the adapted digital signature is valid; and then granting access to an electronic service if the adapted digital signature is valid.

A method and apparatus for an adapted digital signature is also provided. According to an aspect of the present inventions, the adapted digital signature is generated using a digital signature engine and an adaptation algorithm.

According to one embodiment, a method for creating an adapted digital signature comprises: retrieving an originator key, the originator key corresponding to a local userid; running a digital signature engine to create a digital signature, the digital signature based on at least the originator key and remote user information; retrieving a word from a word list, the word indexed to at least a portion of the digital signature; and returning at least the word as the adapted digital signature.

According to another embodiment, a method for verifying an adapted digital signature comprises: retrieving an originator key based on a first portion of address information; generating an adapted digital signature based on the originator key and a second portion of the address information; comparing a third portion of the address information to the adapted digital signature; and accepting the electronic message if the third portion of the address information and the adapted digital signature match.

According to another embodiment, an electronic message system comprises: an authenticated message server configured to remove inbound electronic messages if an authenticated electronic userid cannot be verified; and a mail host coupled to the authenticated message server; and wherein the authenticated message server is configured to remove inbound electronic messages by performing the acts of: generating an adapted digital signature; comparing a portion of an inbound electronic message to the adapted digital signature; and rejecting the inbound electronic message if the portion of the inbound electronic message and the adapted digital signature do not match.

Brief Description of the Drawings

The present inventions are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings in which like reference numerals refer to similar elements and in which:

FIG. 1 is a diagram illustrating one embodiment of an electronic messaging system employing an authenticated message server;

FIG. 2 depicts an alternative embodiment of an electronic messaging system employing an authenticated message server;

FIG. 3 is a functional diagram illustrating one embodiment of an authenticated message server and authenticated electronic userid;

FIG. 4 depicts a functional diagram illustrating of an alternative authenticated message server and authenticated electronic userid;

FIG. 5 is a flowchart depicting the steps of generating an authenticated electronic userid;

FIG. 6 depicts an embodiment of an adapted digital signature technique;

FIG. 7 is a flowchart depicting the steps for verifying an authenticated electronic userid; and

FIG. 8 is a flowchart depicting the steps for verifying an an inbound electronic message comprising an adapted digital signature.

Detailed Description of the Preferred Embodiments

FIG. 1 depicts an electronic messaging system 100 according to one embodiment of the present inventions. System 100 includes a server 108, coupled to a terminal unit or personal computer 104, a router 112, and an authenticated message server 116. The interconnection or coupling mechanism between the various devices is preferably a fiber optic network cable, but it can also be a twisted pair, or a wireless interconnection. According to one embodiment, server 108 is a Sun Microsystems SPARC™ system running electronic message software such as Oracle Corporation's InterOffice™ messaging server. Router 112 is a commercially available internet router such as a Cisco Systems 7500 Series router.

Authenticated message server 116 can run on a standard personal computer, such as an Intel Pentium™ based microprocessor system. However, authenticated message server 116 is alternatively part of the software component stack added to server 108. In such an embodiment, an application programming interface ("API") for the messaging server 108 is added which provides access to the authenticated message server services, such as the methods and techniques for generating and verifying authenticated electronic userids as described herein. In the broader spirit of the inventions, the system can be

highly distributed, wherein incoming and outgoing messages are handled by separate servers or computer systems on an interconnected network (e.g. a local area network or "LAN").

From the server 108, outgoing electronic messages to remote users are typically passed through an internet gateway router, such as router 112. Router 112 is preferably connected to the internet 120 via a T1 pipeline, or other leased line. Conversely, messages from the internet 120 to a particular local user associated with the server 108 will be passed through router 112.

A remote user typically resides on a personal computer, such as laptop 132, which is also connected to a server 128. Server 128 is configured similar to server 108, but it can also be a different type of server, such as a Digital Equipment Corporation VAX/VMS™ system. The server 128 is likely to run a different messaging system, such as the University of Washington PINE™ messaging system. Similar to router 112, router 124 is connected to server 128 and the internet 120.

In one embodiment, electronic message system 100 further comprises a wireless short message service ("SMS") system. An e-mail to SMS gateway receives an e-mail message (preferably an authenticated message) from router 112 or authenticated message server 116. The gateway converts the e-mail into one or multiple short messages, typically of 160 characters in length, and forwards the short messages to an SMS center. In turn, the SMS center forwards the message over a wireless link (e.g., a wireless local loop) to a local user (e.g., here, the receiving device can be a pager or a cellular telephone). A wireless short message service system is available from Omnipoint Corporation.

FIG. 2 is an overview of an alternative electronic messaging system 200 employing the inventions described herein. Internet 204 is a wide area network of interconnected computers. Connected to internet 204 via a simple mail transfer protocol ("SMTP") connection is a mail exchanger 208. (SMTP is further described in publicly available Internet RFC 821.) A mail exchanger, as used herein, is a server that transmits and receives electronic messages (e.g., e-mail) via the internet 204. The mail exchanger 208 resides in an internal network (e.g., a local area network). The mail exchanger 208 is the designated sender and receiver of e-mail between the internal network and the internet. For load balancing purposes, more than one mail exchanger 208 may service an internal network. The designation of a mail exchanger, such as mail exchanger 208, is preferably defined by a domain name server ("DNS") in a mail exchange record.

Connected to mail exchange server 208, also via an SMTP, is authenticated message server 212. The authenticated message server 212 is configured to perform

functions associated with the generation and authentication of authenticated electronic userids, as is described herein.

Connected to authenticated message server 212 via an SMTP link is a mail host 216. Mail host 216 receives inbound e-mail messages and stores them for reading by a user. Mail host 216 can also send outbound e-mail messages created by the user. Because mail host 216 supports SMTP and post office protocol version 3 ("POP3), it can be embodied in virtually any mail server software, such as Microsoft Exchange Server and Lotus Notes. (POP3 is further described in publicly available Internet RFC 1939.) Thus, mail host 216 supports both inbound and outbound electronic messaging.

Optionally connected to authenticated message server 212 via a hyper text transfer protocol ("HTTP") link is an administration interface 224. (HTTP is further described in publicly available Internet RFC 1945.) An administrator is able to configure the authenticated message server 212 via a web browser or equivalent device through data exchanges via HTTP and the administration interface 224.

Users are able to connect to the mail host 216 via a POP3 or an SMTP connection by way of one or more user e-mail clients 220. Embodiments of e-mail clients include the Netscape Communicator available from Netscape Corporation in Mountain View, California and the Microsoft Outlook client, available from Microsoft Corporation in Redmond, Washington.

FIG. 3 depicts a functional overview of an authenticated message server 300. According to one embodiment, the authenticated message server 300 comprises a digital signature engine 318 and an adaptation algorithm 320.

According to a presently preferred embodiment, a local user "roger", who is using an electronic message system, such as one running on server 108 (identified by the host or domain name "domain.com"), composes and requests to send a message to a remote user identified as "jenny@mailer.com". When local user "roger" requests to send the message to remote user "jenny@mailer.com", a portion of the message, in particular the remote userid 308 and the originator userid 304, is passed to a digital signature engine 318 for processing. Digital signature engine 318 can also store the local user's (e.g. roger's) private key, depicted in FIG. 3 as originator key 312. Alternatively, the local user's originator key 312 can be sent in addition to or separate from the request by the messaging system residing on server 108. Preferably, originator key 312 is a 256 bit value.

Remote userid 308, originator userid 304 and originator key 312 are passed to one-way hash function 316 in digital signature engine 318. In the present case, remote userid 308 is the value "jenny@mailer.com", originator userid 304 is the value "roger" and originator key 312 is the (partial) originator key for local user "roger", which has a value of "3CF0 40A9 ... 06E0 080116". One-way hash function 316 performs a computational

algorithm on inputs 304, 308 and 312 to generate a fix-length array of bits called a hash value, but referred to herein as a "digital signature" 319.

Preferably, the one-way hash function 316 is the Message Digest 5 ("MD5") function. The MD5 function is described in RFC 1321, entitled "The MD5 Message-Digest Algorithm", by R. Rivest and written in 1992. However, in other embodiments, the computation algorithm is an encryption algorithm that produces a variable length digital signature.

An example of an encryption algorithm that will work in the present invention is the data encryption algorithm defined in ANSI document X3.92-1981 (R1987) entitled "Data Encryption Algorithm". Using a data encryption algorithm, the same inputs as were used to produce the hash value are instead encrypted with an authenticated message server public key or a local user's public key. Note that when such an authenticated electronic userid is returned, it can either be decoded with an authenticated message server private key or a local user's private key, or it can be recomputed using the authenticated message server public key or local user's public key.

Once the digital signature 319 is computed, the digital signature 319 is passed on to adaptation algorithm 320. Adaptation algorithm 320 transforms, or maps the digital signature 319 to an acceptable form for transmission in a return e-mail address. Preferably, a base64 conversion is performed by adaptation algorithm 320, whereby the conterminous 6 bit strings of the digital signature are mapped to ASCII characters as follows:

| | |
|---|---|
| 000000 - 011001 | A - Z |
| 011010 - 110011 | a - z |
| 110100 - 111101 | 0 - 9 |
| 111110 | + |
| 111111 | / |

In one embodiment, the output of the adaptation algorithm 320 is an adapted digital signature 328. However, in another embodiment the functionality of the adaptation algorithm 320 is performed by logic circuitry, or it is embedded into the particular computational function (e.g., one-way hash function 316) directly. In still another embodiment, the digital signature 319 does not need to be transformed with a base64

conversion; rather, the messaging system 100 supports binary and other digital formats. However, transforming the digital signature 319 into an adapted digital signature 328 in the form of ASCII characters is preferred, since most legacy systems (e.g., internet e-mail) will generally support the character set. Additionally, the character set is easily replicated on a variety of input devices (e.g., computer keyboards, telephones, etc.) on which the authenticated electronic userid 350 can be typed.

The adapted digital signature 328 will become part of an authenticated electronic userid 350 for the outbound message to the remote user "jenny@mailer.com". Identifiers 324, 328 and 332, together with the other symbols (e.g., a period, an underscore, a hyphen, an ampersand, etc.) are concatenated to form authenticated electronic userid 350. For example, the return address of local user "roger" would appear similar to the address "roger.SrTwIFa9/Da4qwP@domain.com". The authenticated electronic userid 350 will be the return/reply address to local user "roger".

Assuming authorization is otherwise not granted to remote user "jenny@mailer.com", then the only way remote user "jenny@mailer.com" can send an electronic message to local user "roger" is with a message addressed to the authenticated electronic userid 350. Since local user "roger" controls whether remote user "jenny@mailer.com" will receive an authenticated electronic userid 350 with which to send him an electronic message, unsolicited electronic messages and/or unsolicited bulk e-mail from remote user "jenny@mailer.com" should not occur.

FIG. 4 depicts a slightly modified functional overview of authenticated message server 300-here identified as authenticated message server 400. Again, the digital signature engine 418 is preferably embodied in the authenticated message server 400. It is noted that the adaptation algorithm 420 is different than the adaptation algorithm 320 shown in FIG. 3. An improvement in the adaptation algorithm is described below with reference to FIG. 6. Moreover, the authenticated electronic userid 450 is different from authenticated electronic userid 350. Modifications include the use of a plus sign "+" delineator rather than a period between the local userid 424 and the adapted digital signature 428. Significantly, the adapted digital signature 428 is no longer an unrememberable value, but rather a rememberable value.

Turning now to FIG. 5, it depicts a flowchart of the process of generating the authenticated electronic userid 350 shown in FIG. 3. In step 504, a request for an authenticated electronic userid 350 is received by the authenticated message server 116. According to one embodiment, an outbound message, which comprises the request, is separated in step 508 and data from the "to:" and "from:" fields is extracted. Additionally, the originator key 312 is also separated, if it is included with the message, or it can be stored and retrieved from a table which is part of the authenticated message server 116.

According to one embodiment, the outbound message also comprises pre-processing security level field that identifies a level of security the message is to receive. For example, a "0" security level indicates no authenticated electronic userid is required for the message, where as a "1" indicates that the authenticated electronic userid is good for any person at the host or domain name of the remote user or message recipient. A "2" indicates that the authenticated electronic userid is good only for the remote user or message recipient, and a "3" indicates that the electronic userid is good only for a preset period of time (e.g., 24 hours) for a particular remote user. In one embodiment of an authenticated electronic userid, the value in the security level field is retained as a portion of the adapted digital signature 228. Various levels and techniques for identifying the security level of the authenticated electronic userid can be used.

Data extracted in the separating step 508, together with the originator key 312 are hashed by the one-way hash function 316 in step 512, preferably using an MD5 hash function, to generate the digital signature 319. After step 512, the digital signature 319 is converted at step 516 using a base64 conversion algorithm. The output of the base64 conversion algorithm is the adapted digital signature 328. The adapted digital signature 328 will, in part, grant the remote user "jenny@mailer.com" privilege to reply or send a message to local user "roger".

In step 520, the output of the adaptation algorithm 320, that is, adapted digital signature 328, the originator identifier 324 and the originator's host or domain name 332 are concatenated as a single authenticated electronic userid (e.g. userid 350). According to one embodiment, the result is stored in an authentication log file that can be indexed and/or searched for matching strings and/or authorization levels in the future. The advantage of such a system is that the authenticated message server 116 can track and record incoming and outgoing messages and privileges so that security breaches can be tracked and examined by an administrator.

In step 528, the authenticated electronic userid 350 is returned to the message server (e.g. server 108). According to one embodiment the process is repeated for the remote user specified in the "cc:" field. When the message server (e.g. 108) spools out messages to the other remote users, the "from:" field will now contain a unique authenticated electronic userid for each of the other users as well. However, in another embodiment the identity of other remote users identified in the "to:" and "cc:" fields are recorded in an authentication log file so they can be matched with the appropriate inputs used when the authenticated electronic userid 350 was created.

In another embodiment, the authenticated message server 116 supports explicit requests for an authenticated electronic userid 350 without the need for sending a message through the message server (e.g. server 108). Such a system can be employed where a

local user specifically requests an authenticated electronic userid 350 or desires to give such a userid to a remote user, organization or internet application (e.g., a distribution list.) Instead of spooling out a message with the authenticated electronic userid 350, the authenticated message server 116 will return the authenticated electronic userid 350 directly to the local user.

FIG. 6 depicts an alternative embodiment of the adaptation algorithm 420 shown in FIG. 4 or also adaptation algorithm 320 shown in FIG. 3. A local userid list 604 is shown to illustrate the relationship between local userids and originator keys – shown in originator key list 612.

According to a presently preferred embodiment, thirty-seven originator keys are used, each originator key having a one-to-many relationship with local userids 604. The first character of local userids 604 determines which originator key is associated with it. Twenty-six keys are reserved for letters A-Z (case insensitive), ten for numbers 0-9, and a miscellaneous key for characters not matching the first thirty-six values. According to an alternative embodiment, any number of originator keys, n, can be used. In yet another embodiment, a database can be maintained by the mail host 216 or the authenticated message server 212 that identifies local userids and their preferences (e.g., always reject messages having an invalid adapted digital signature). If each local userid is allowed one or more originator keys, then the database can store them.

Digital signature engine 418, shown as hash function 620 (preferably the MD5 function), combines a local userid 608, "Alice", with Alice's corresponding originator key 610 and remote user information 616. Remote user information includes at least a domain name and can also include the remote userid. The output of the digital signature engine 418 (shown here hash function 620) is a digital signature (or "hash value" 624, as the case may be). The digital signature is preferably a 128-bit value. The adaptation algorithm 626 then modifies the digital signature.

Adaptation algorithm 626 first performs a boolean function 628 on the hash value 624. The extent to which the hash value 624 is modified depends on the size of a word list 636. According to a presently preferred embodiment, the word list is 4096 words long (as used herein, "words" does not refer to a length of a value, rather it refers to the value itself – a word in the word list can be virtually any length), however, the word list 636 can be any length, m, depending on the degree of security desired (the more words, the greater the security). Since 4096 words are in the word list, the extent of the modification is such that it yields a value that is equal to or greater than the number of words, m, in the word list 636. The boolean function 628 modifies the hash value 624 into a 12-bit value referred to herein as a "modified digital signature", or more specifically a "modified hash value". In one embodiment, the boolean function 628 selects the first twelve bits as the

modified hash value. In another embodiment, AND or OR functions can combine one or more preset bit masks to generate the modified hash value.

The modified hash value from the boolean function 628 is passed to the adapted digital signature selector 632. The adapted digital signature selector 632 includes the word list 636 and, optionally, a number generator 640. The adapted digital signature selector 632 selects a particular word from the word list 636 using the modified hash value from the boolean function 628.

According to one embodiment, a modulus function (e.g., the C language modf function or % operator) is applied to the modified hash value, the base being the number of words, m, in the word list 636. If the modulus function returns zero, then the adapted digital signature selector 632 retrieves a word corresponding to (i.e., indexed to) the modified hash value. However, if the modulus function returns a value other than zero, then the adapted digital signature selector 632 retrieves a word corresponding to the value returned by the modulus function (e.g., the remainder).

For example, if the modified hash value is 3 and there are 5 words in the word list 636, then word3 is the word selected from the word list 636. However, if the modified hash value is 7 and there are 5 words in the word list 636, then word2 is the word selected from the word list 636.

The number generator 640 generates a calculated number, a preset number (e.g., identifying a status or mode for the adapted digital signature 652), or any combination thereof. Preferably, the number generator 640 generates a number based on the remaining 116 bits from the digital signature (or hash value 624). According to one embodiment, a six digit ASCII number is generated. The first digit corresponds to the mode of the adapted digital signature (e.g., which set of remote user information was used as an input to the digital signature engine 418 – the remote user domain name, or the remote userid and domain name). The subsequent five digits are based upon a bit pattern of the unused portion of the hash value 624. For example, sixteen bits of the 116 bits can be selected and a combination of those sixteen bits can be turned into the five digit number.

The value 660 generated by the number generator 640 is appended to the word 656 selected from the word list 636 to form the adapted digital signature 652. The adapted digital signature 652 is concatenated with a local userid 608 and a domain name 664 to form the authenticated electronic userid 644. A delineator (e.g., "+") separates the local userid 608 from the adapted digital signature 652, while the at sign ("@") separates the adapted digital signature 652 from the domain name 664. Of course, other delineators, such as the minus sign ("-"), the underscore ("_"), the period (".), the equal sign ("=") or fixed length values can be used to delineate the address information.

If added security is desired, then the word list 636 can be bit-wise barrel-shifted or otherwise scrambled so that the values in the word list 636 cannot be casually copied. Accordingly, the scrambled value can be converted by the adaptation algorithm 626 when the word is needed, or just before concatenation of the adapted digital signature 652 to form the authenticated electronic userid 644.

FIG. 7 is a flowchart depicting the steps for verifying an authenticated electronic userid 350 based on a message from a remote user. In step 704, an inbound message is passed from router 112 (FIG. 1) to server 108 and is then received by authenticated message server 116. In step 708, header information, also known as envelope information, is separated from the inbound message, and in particular the remote user's domain name, the remote userid and the authenticated electronic userid 350 are extracted. Referring to FIG. 3, the left side of inbound authenticated electronic userid 350, specifically originator identifier 324 (e.g., "roger"), is tested in step 712 to confirm that the user is a valid local user on the messaging system 108. If the originator identifier 324 does not identify a valid local user, then the authenticated message server 116 processing continues to step 736, which is explained in further detail below. If the identifier 324 contains a valid local user, then the process continues to step 716.

In step 716, the authenticated message server 116 performs a lookup on the originator key (e.g., key 312) related to the local user "roger". Next, in step 720, a hash (or alternatively a data encryption algorithm) is performed on the local user's originator key 312, in combination with the remote user name (e.g., "jenny@mailer.com") 308 by the digital signature engine 318. In step 724, the digital signature 319 returned by the digital signature engine 318, at step 720, is converted to ASCII characters by adaptation algorithm 320. The result of the conversion (the adapted digital signature 328) is compared with the adapted digital signature of the inbound message (that is, the portion of the authenticated electronic userid 350 between the "." (period) and the "@" (at symbol)) in step 728. If a match is confirmed, then the authenticated message server 116 continues to step 732, where the inbound message is accepted and passed on to the message server 108. From here, the process terminates, since the local user "roger" can retrieve the message from the message server 108.

However, if a match is not verified in step 728, or if the local user does not exist (step 712), then the message is rejected at step 736. According to one embodiment, the remote sender is notified of the rejection and the process ends. However, if tracking is desired, then information about the inbound message (i.e., remote userid, remote host, date, time, etc.) is recorded in a failure log file for examination by a system administrator at a later time.

FIG. 8 depicts an alternative method for processing an inbound electronic message comprising an adapted digital signature 652.

In act 804, an inbound electronic message is received over the internet 204 at the mail exchanger 208. According to one embodiment, the inbound electronic message comprises message header information, such as an SMTP "MAIL From" address and an SMTP "RCPT To" address. In act 808, authenticated message server 212 parses the "to:" field ("receiver" information) from the address information (e.g., the "RCPT To" information in the SMTP message) to identify a local userid and, possibly, an adapted digital signature. The "from:" field ("remote user" or "sender" information) can also be parsed in act 808. Next, in act 812, a test is performed on the receiver information to determine whether an associated local userid is protected by the authenticated message server 212. If the associated local userid is not protected, then in act 816, the message is accepted and passed on to the mail host 216. If the associated userid is protected, then processing continues to act 820.

In act 820, the authenticated message server 212 tests the receiver information parsed in act 808 to determine whether the receiver information comprises an adapted digital signature 652. If the receiver information does not include an adapted digital signature 652, then in act 824 the message is conditionally accepted but marked as unsigned. In one embodiment, if a local user or the administrator has configured the authenticated message server 212 to reject all unsigned messages, then a receipt log record can be made recording the message header information and the message can then be purged. However, in another embodiment, the administrator, or the local user, may specify that unsigned messages must be queued to a particular location for later manual review. If the receiver information does include an adapted digital signature 652 then processing continues to act 828.

In act 828, a key lookup is performed. According to one embodiment, a key lookup includes matching a local userid (e.g., from the local userid list 604) with the local userid in the authenticated electronic userid (that is, the portion of the userid before the "+") and then retrieving the corresponding originator key from the originator key list 612. In act 832, the remote user information 616, together with the retrieved originator key (e.g., originator key 610) and the local userid 608 are used to calculate a hash value 624 with the hash function 620.

It is important to note that if mode information is contained with the inbound adapted digital signature, then the particular remote user information used by the hash function 620 can vary. Thus, according to one embodiment, the first digit of the number 660 will determine which remote user information to include as an input to the hash function 620.

In act 836, the adaptation algorithm 626 adapts the hash value 624 to form an adapted digital signature 652 (e.g., the word 656 and number 660). In act 840, the newly created adapted digital signature is compared with the adapted digital signature in the inbound e-mail message receiver information. If the two adapted digital signatures match, then processing continues to act 848. However, if the two adapted digital signatures do not match, then the inbound e-mail message is rejected by the authenticated message server 212.

In act 848, the inbound e-mail message is accepted by the authenticated message server 212 and marked as signed. Once the inbound e-mail message is marked as signed, it can be passed to the mail host 216 for access by the user e-mail client 220.

According to one embodiment, the word list 636 is not configurable after set up of the authenticated message server 212. Rather, the word list 636 is must be modified prior to initialization of the authenticated message server 212. However, if a post set up modifiable word list is desired, then a substitution list can be maintained. According to one embodiment, the substitution list is a two field, multi-row table configured to hold a first word and a second word in each row. A removed word field (column) holds the word that was removed from the word list 636 and a new word field (column) holds the new word substituted for the replaced word.

Thus, when an inbound e-mail message is received at the authenticated message server 212 the authentication process can further involve testing the substitution list to determine whether the word 656 in the adapted digital signature 652 is a word in the removed word field of the substitution list. If the word 656 is in the removed word field of the substitution list, then when the adaptation algorithm is performed the word selected by the adapted digital signature selector 632 from the word list 636 is matched with a word in the new word field in the substitution list. The word selected by the adapted digital signature selector 632 from the word list 636 is then replaced with the word in the replaced word field of the substitution list.

According to one embodiment of the invention, the electronic message body is not accepted via the SMTP process unless the authenticated message server 212 verifies the adapted digital signature. Such an embodiment saves bandwidth. However, according to an alternative embodiment, the authenticated message server 212 verifies the adapted digital signature after the message body is (conditionally) accepted.

In still another embodiment, the functionality of the mail exchanger 208 can be incorporated into the authenticated message server 212.

According to one embodiment, the steps for generating and verifying an authenticated electronic userid are performed by a computer program functioning as a stand-alone server, or in an add-on software component in a message server. In one

embodiment, the instructions for performing the methods and techniques described herein (the computer program) are stored on a computer readable medium, such as an electromagnetic storage device (e.g., a floppy disk, a magnetic tape, a hard-disk drive, or other persistent memory device), or an optical data storage medium (e.g., a CD-ROM). Generally, prior to execution of the sequences of instructions, the sequences of instructions are copied from a non-volatile computer readable medium (e.g., the hard-disk drive) to a volatile source (e.g., random access memory) and are executed from the volatile computer readable medium. For purposes of explanation, the methods and techniques described herein were described with reference to an authenticated message server. Where the actual functionality is performed, that is on which piece of hardware, is not important for purposes of this description. For example, server 108 can be configured to perform the functionality of both a message server and an authenticated message server.

The present inventions are particularly useful as a spam (or junk e-mail) filter. Advantages of the present invention include that it integrates into existing electronic messaging infrastructure (e.g., SMTP and POP3 systems) without requiring additional hardware or software by both the sender and receiver. There is no need to share proprietary encryption/decryption algorithms or keys between a message sender and recipient as in traditional symmetric or asymmetric encryption algorithms. Further, it greatly reduces the chance of spoofing by a spammer by verifying the recipient information without requiring a handshake or real-time connection between a sender and a recipient. Finally, the present invention does not rely on complicated linguistic or content-based rules for filtering spam. Rather, the invention can be realized without reference to the content of the inbound message body.

In the foregoing specification, the inventions have been described with reference to specific embodiments thereof. It will be evident, however, that various modifications and changes can be made thereto without departing from the broader spirit and scope of the invention. For example, larger or smaller originator keys (e.g., 48 or 128 bit originator keys) can be used. Further, the adapted digital signature can be truncated in order to not exceed the boundaries of the address field in an electronic message. Further still the authenticated message server functionality can be incorporated into the message server (e.g. server 108) rather than in a stand-alone device. In still another embodiment, part of the authenticated message server functionality (e.g., generating an authenticated electronic userid) can be performed in a client application running on the local user's computer, rather than passing the function on to the message server or authenticated message server. In yet another embodiment, the authenticated electronic userid is created by a smartcard coupled to the local user's computer, or a smartcard connected to a user's wireless

telephone. The specification and drawings are, accordingly, to be regarded in an illustrative, rather than a restrictive sense.

Claims

What is claimed is:

1. A method for verifying an authenticated electronic userid comprising:

receiving an electronic message from a remote user;

extracting an originator identifier and a first adapted digital signature from said electronic message;

retrieving an originator key based on said originator identifier, said originator key not being shared with said remote user;

generating a second adapted digital signature, said second adapted digital signature based on at least said local userid and said originator key;

comparing said first adapted digital signature to said second adapted digital signature;

accepting said electronic message from said remote user if said first adapted digital signature and said second adapted digital signature match; and

rejecting said electronic message from said remote user if said first adapted digital signature and said second adapted digital signature do not match.

2. The method of claim 1, wherein said act of generating said second adapted digital signature comprises:

hashing said originator key and a local userid with one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

3. The method of claim 1, wherein said act of generating said second adapted digital signature comprises:

performing an encryption function using said originator key and a local userid with one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

4. The method of claim 1, wherein said second adapted digital signature is further based on at least a portion of remote user information.

5. The method of claim 1, further comprising:

comparing said originator identifier to a list of local users; and

rejecting said electronic message is if said originator identifier is not found in said list of local users.

6. A method for creating an authenticated electronic userid comprising:

receiving a request for said authenticated electronic userid;

retrieving an originator key, said originator key corresponding to a local userid;

generating an adapted digital signature, said adapted digital signature based on said originator key, said local userid, and one or more other identifiers;

concatenating said adapted digital signature with at least an originator identifier; and

returning a result of said act of concatenating as said authenticated electronic userid.

7. The method of claim 6, wherein said act of generating said adapted digital signature comprises:

hashing said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said adapted digital signature.

8. The method of claim 6, wherein said act of generating said second adapted digital signature comprises:

performing an encryption function using said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

9. The method of claim 6, wherein said second adapted digital signature is further based on at least a portion of remote user information.

10. An electronic message system comprising:

a computer configured to run an electronic message server application;

a router coupled to said computer, said router configured to forward a first electronic message from a local user, said first electronic message comprising a first authenticated electronic userid, and said router further configured to receive a second electronic message from a remote user, said second electronic message comprising a second authenticated electronic userid; and

a computer program stored in a memory device coupled to said computer, said computer program configured to cause said computer to generate said first authenticated electronic userid for said first electronic message, said first electronic userid having an adapted digital signature and an originator identifier, and said computer program further configured to cause said computer to reject said second electronic message if said computer cannot re-generate said adapted digital signature from envelope information associated with said second electronic message and match said re-generated adapted digital signature with a portion of said second authenticated electronic userid.

11. The electronic message system of claim 10, wherein said computer program is further configured to generate said adapted digital signature by:

hashing an originator key, a local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said adapted digital signature.

12. The electronic message system of claim 10, wherein said computer program is further configured to:

extract an originator identifier from said envelope information associated with said second electronic message;

compare said originator identifier to a list of local users; and

reject said second electronic message if said originator identifier does not match a local userid in said list of local users.

13. An authenticated message server configured to create and verify an authenticated electronic userid,

wherein creating said authenticated electronic userid comprises:

receiving a request for said authenticated electronic userid;

retrieving an originator key, said originator key corresponding to a local userid;

generating a first adapted digital signature, said first adapted digital signature based on said originator key, said local userid, and one or more other identifiers;

concatenating said first adapted digital signature with at least an originator identifier; and

returning a result of said step of concatenating as said authenticated electronic userid; and

wherein verifying said authenticated electronic userid comprises:

receiving an electronic message from a remote user, said electronic message comprising said authenticated electronic userid;

extracting said originator identifier and first adapted digital signature from said authenticated electronic userid;

retrieving said originator key based on said originator identifier;

generating a second adapted digital signature, said second adapted digital signature based on at least said local userid and said originator key;

comparing said first adapted digital signature to said second adapted digital signature;

accepting said electronic message from said second remote user if said first adapted digital signature and said second adapted digital signature match; and

rejecting said electronic message from said remote user if said first adapted digital signature and said second adapted digital signature do not match.

14. The authenticated message server of claim 13, wherein said acts of generating said first adapted digital signature and said second adapted digital signature comprise:

hashing said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said adapted digital signature.

15. The authenticated message server of claim 13, wherein said act of generating said first adapted digital signature and said second adapted digital signature comprises:

performing an encryption function using said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

16. The authenticated message server of claim 14, wherein said one or more other identifiers include remote user information.

17. The authenticated message server of claim 15, wherein said one or more other identifiers include remote user information.

18. The authenticated message server of claim 13, wherein said act of verifying said authenticated electronic userid further comprises:

extracting said originator identifier from said envelope information associated with said electronic message;

comparing said originator identifier to a list of local users; and

rejecting said electronic message if said originator identifier does not match a particular local userid in said list of local users.

19. A method for filtering junk electronic mail, comprising:

receiving an electronic message from a remote user;

generating an adapted digital signature based on an originator identifier and remote user information from said electronic message and an originator key, said act of generating comprising:

hashing a local userid associated with said originator identifier, said remote user information and said originator key to form a digital signature;

transforming said digital signature from a first digital format to a second digital format; and

returning said digital signature in said second digital format as said adapted digital signature;

comparing said adapted digital signature to a portion of said electronic message;

accepting said electronic message if said adapted digital signature and said portion of said electronic message match; and

rejecting said electronic message if said adapted digital signature and said portion of said electronic message do not match.

20. The method of claim 19, wherein said electronic message is a reply to a first electronic message sent from a local userid, said first electronic message comprising said originator identifier, and wherein said portion of said electronic message compared to said adapted digital signature being generated by acts associated with said local userid.

21. The method of claim 20, wherein said acts associated with said local userid comprise:

hashing said local userid, said remote user information and said originator key to form a first digital signature;

transforming said first digital signature from said first digital format to said second digital format; and

returning said first digital signature in said second digital format as said portion of said electronic message.

22. A computer readable medium having stored therein one or more sequences of instructions for verifying an authenticated electronic userid, said one or more sequences of instructions causing one or more processors to perform a plurality of acts, the acts comprising:

receiving an electronic message from a remote user;

extracting an originator identifier and a first adapted digital signature from said electronic message;

retrieving an originator key based on said originator identifier, said originator key not being shared with said remote user;

generating a second adapted digital signature, said second adapted digital signature based on at least said local userid and said originator key;

comparing said first adapted digital signature to said second adapted digital signature;

accepting said electronic message from said remote user if said first adapted digital signature and said second adapted digital signature match; and

rejecting said electronic message from said remote user if said first adapted digital signature and said second adapted digital signature do not match.

23. The computer readable medium of claim 22, wherein said act of generating said second adapted digital signature comprises:

hashing said originator key and a local userid with one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

24. The computer readable medium of claim 22, wherein said act of generating said second adapted digital signature comprises:

performing an encryption function using said originator key and a local userid with one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

25. The computer readable medium of claim 22, wherein said second adapted digital signature is further based on at least a portion of remote user information.

26. The computer readable medium of claim 22, further comprising:

comparing said originator identifier to a list of local users; and

rejecting said electronic message is if said originator identifier is not found in said list of local users.

27. A computer readable medium having stored therein one or more sequences of instructions for creating an authenticated electronic userid, said one or more sequences of instructions causing one or more processors to perform a plurality of acts, the acts comprising:

receiving a request for said authenticated electronic userid;

retrieving an originator key, said originator key corresponding to a local userid;

generating an adapted digital signature, said adapted digital signature based on said originator key, said local userid, and one or more other identifiers;

concatenating said adapted digital signature with at least an originator identifier; and

returning a result of said act of concatenating as said authenticated electronic userid.

28. The computer readable medium of claim 27, wherein said act of generating said adapted digital signature comprises:

hashing said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said adapted digital signature.

29. The computer readable medium of claim 27, wherein said act of generating said second adapted digital signature comprises:

performing an encryption function using said originator key, said local userid, and one or more other identifiers to form a digital signature; and

converting said digital signature from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature.

30. The computer readable medium of claim 27, wherein said second adapted digital signature is further based on at least a portion of remote user information.

31. A computer readable medium having stored therein one or more sequences of instructions for filtering junk electronic mail, said one or more sequences of instructions causing one or more processors to perform a plurality of acts, the acts comprising:

receiving an electronic message from a remote user;

generating an adapted digital signature based on an originator identifier and remote user information from said electronic message and an originator key, said act of generating comprising:

hashing a local userid associated with said originator identifier, said remote user information and said originator key to form a digital signature;

transforming said digital signature from a first digital format to a second digital format; and

returning said digital signature in said second digital format as said adapted digital signature;

comparing said adapted digital signature to a portion of said electronic message;

accepting said electronic message if said adapted digital signature and said portion of said electronic message match; and

rejecting said electronic message if said adapted digital signature and said portion of said electronic message do not match.

32. The computer readable medium of claim 31, wherein said electronic message is a reply to a first electronic message sent from a local userid, said first electronic message comprising said originator identifier, and wherein said portion of said electronic message compared to said adapted digital signature being generated by acts associated with said local userid.

33. The computer readable medium of claim 32, wherein said acts associated with said local userid comprise:

hashing said local userid, said remote user information and said originator key to form a first digital signature;

transforming said first digital signature from said first digital format to said second digital format; and

returning said first digital signature in said second digital format as said portion of said electronic message.

34. A method for creating an adapted digital signature comprising:

retrieving an originator key, said originator key corresponding to a local userid;

running a digital signature engine to create a digital signature, said digital signature based on at least said originator key and remote user information;

retrieving a word from a word list, said word corresponding to at least a portion of said digital signature; and

returning at least said word as said adapted digital signature.

35. The method of claim 34, further comprising performing a boolean function on said digital signature to create a modified digital signature, and wherein said word is retrieved based upon said modified digital signature.

36. The method of claim 34, further comprising

generating a number; and

appending said number to said word to form said adapted digital signature.

37. The method of claim 34, further comprising concatenating said adapted digital signature with said local userid and a domain name.

38. The method of claim 34, wherein running said digital signature engine includes

performing a one-way hash function, said one-way hash function using at least said originator key and said remote user information, said one-way hash function generating a hash value, and said hash value being said digital signature.

39. A method for verifying an adapted digital signature comprising:

retrieving an originator key based on a first portion of address information;

generating an adapted digital signature, said act of generating comprising:

creating a digital signature based on at least said originator key and a second portion of said address information;

retrieving a word from a word list, said word corresponding to said digital signature;

returning at least said word as said adapted digital signature;

comparing third portion of said address information to said adapted digital signature; and

accepting said electronic message if said third portion of said address information and said adapted digital signature match.

40. The method of claim 39, further comprising:

testing said first portion of said address information to determine whether a local user identified by said receiver information employs authenticated message server services; and

accepting said electronic message if said local user does not employ said authenticated message server services.

41. The method of claim 39, wherein said second portion of said address information includes a sender domain name and said first portion of said address information includes a local userid.

42. The method of claim 39, wherein generating said adapted digital signature further comprises:

creating a modified digital signature from said digital signature, said modified digital signature created with a boolean function, and wherein said word is retrieved from said word list based upon said modified digital signature;

generating a number; and

appending said number to said word.

43. The method of claim 39, wherein creating said digital signature includes executing a one-way hash function, said one-way hash function using at least said originator key and said second portion of said address information, said one-way hash function generating a hash value, and said hash value being said digital signature.

44. A electronic message system comprising:

an authenticated message server, said authenticated message server configured to remove an inbound electronic message if an authenticated electronic userid cannot be verified, said inbound electronic message including address information;

and a mail host coupled to said authenticated message server; wherein

said authenticated message server is configured to remove said inbound electronic message by performing the acts of:

generating an adapted digital signature, said act of generating comprising:

creating a digital signature based on at least an originator key and a first portion of said address information;

retrieving a word from a word list, said word corresponding to said digital signature; and

returning said word as said adapted digital signature;

comparing a second portion of address information to said adapted digital signature; and

rejecting said inbound electronic message if said second portion of said address information and said adapted digital signature do not match.

45. The electronic message system of claim 44, further comprising a mail exchanger coupled to said authenticated message server and configured to receive said inbound electronic message.

46. The electronic message system of claim 44, wherein said authenticated message server is configured to perform the act of parsing sender information and receiver information from said address information, said receiver information including a local userid and a second adapted digital signature.

47. The electronic message system of claim 44, wherein creating said digital signature includes executing a one-way hash function, said one-way hash function using at least said originator key and a portion of said address information, said one-way hash function generating a hash value, and said hash value being said digital signature.

48. The electronic message system of claim 44, wherein said act of generating said adapted digital signature further comprises performing a boolean function on said digital signature to create a modified digital signature, and wherein said word is retrieved based on said modified digital signature.

49. The electronic message system of claim 44, wherein said authenticated message server is further configured to perform the acts of:

generating a number; and

appending said number to said word to form said adapted digital signature.

## AMENDED CLAIMS

[received by the International Bureau on 9 November 1999 (09.11.99);
original claims 1-49 replaced by new claims 1-36 (11 pages)]

1. A method for verifying an authenticated electronic userid (644) comprising:
receiving an electronic message from a remote user;
extracting an originator identifier (608) and a first adapted digital signature (652) from said electronic message;
retrieving an originator key (610) based on said originator identifier (616), said originator key (610) not being shared with said remote user;
generating a second adapted digital signature (652), said second adapted digital signature (652) based on a local userid (608), said originator key (610), and one or more other identifiers, and wherein said local userid (608) corresponds to said originator identifier (608);
comparing said first adapted digital signature (652) to said second adapted digital signature (652);
accepting said electronic message from said remote user if said first adapted digital signature (652) and said second adapted digital signature (652) match; and
rejecting said electronic message from said remote user if said first adapted digital signature (652) and said second adapted digital signature (652) do not match.

2. The method of claim 1, further comprising:
comparing said originator identifier (608) to a list of local users (604); and
rejecting said electronic message is if said originator identifier (608) does not match at least one local userid in said list of local users (604).

3. The method of claim 1, wherein said electronic message is addressed to said authenticated electronic userid (644).

4. A method for creating an authenticated electronic userid (644) comprising:
receiving a request for said authenticated electronic userid (644);
retrieving an originator key (610), said originator key (610) corresponding to a local userid (608);

generating an adapted digital signature (652), said adapted digital signature (652) based on said originator key (610), said local userid (608), and one or more other identifiers;

concatenating said adapted digital signature (652) with at least an originator identifier (608) corresponding to said local userid (608); and

returning a result of said act of concatenating as said authenticated electronic userid (644).

5. The method of claim 4, wherein said act of concatenating comprises concatenating said adapted digital signature (652) with said originator identifier (608) and a domain name (664).

6. The method of claim 1 or 4, wherein said act of generating said first or said second adapted digital signature (652) comprises:

performing a one-way hash function, using said originator key (610), a local userid (608), and remote user information (616) as inputs, to form a digital signature (624); and

converting said digital signature (624) from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature (652).

7. The method of claim 1 or 4, wherein said act of generating said first or said second adapted digital signature (652) comprises:

performing an encryption function using said originator key (610), said local userid (608), and remote user information (616) to form a digital signature (624); and

converting said digital signature (624) from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature (652).

8. The method of claim 1 or 4, wherein said step of generating said first or said second adapted digital signature (652) comprises:

creating a digital signature (624), said digital signature (624) based on at least said originator key (610), said local userid (608), and remote user information (616);

retrieving a word (656) from a word list (636), said word (656) corresponding to at least a portion of said digital signature (624); and

returning at least said word (656) as said first or said second adapted digital signature (652).

9. The method of claim 8, further comprising performing a boolean operation (628) on said digital signature (624) to create a modified digital signature, and wherein said word (656) is retrieved based upon said modified digital signature.

10. The method of claim 8, further comprising

generating a number (660); and

appending said number (660) to said word (656) to form said first or said second adapted digital signature (652).

11. A method for filtering electronic mail, comprising:

receiving an electronic message from a remote user, said electronic message addressed to an authenticated electronic userid (644);

generating an adapted digital signature (652) based on information from said electronic message, said act of generating comprising:

performing a one-way hash function that uses a local userid (608), remote user information (616), and an originator key (610) to form a digital signature (624), and wherein said local userid (608) corresponds to an originator identifier (608) from said electronic message;

transforming said digital signature (624) from a first digital format to a second digital format; and

returning said digital signature in said second digital format as said adapted digital signature (652);

comparing said adapted digital signature (652) to a portion of said electronic message;

accepting said electronic message if said adapted digital signature (652) and said portion of said electronic message match; and

rejecting said electronic message if said adapted digital signature (652) and said portion of said electronic message do not match.

12. The method of claim 11, wherein said electronic message is a reply to a first electronic message sent from a local user, said first electronic message comprising said originator identifier (608) and said adapted digital signature (652), and wherein said portion of said electronic message compared to said adapted digital signature (652) is generated by acts associated with said local user.

13. The method of claim 11, wherein said step of transforming said digital signature (624) from said first digital format to said second digital format comprises:

retrieving a word (656) from a word list (636), said word (656) corresponding to at least a portion of said digital signature (624) in said first digital format; and

returning at least said word (656) as said digital signature (624) in said second digital format.

14. The method of claim 13, further comprising performing a boolean operation (628) on said digital signature (624) to create a modified digital signature, and wherein said word (656) is retrieved based upon said modified digital signature.

15. The method of claim 13, further comprising

generating a number (660); and

appending said number (660) to said word (656) to form said first or said second adapted digital signature (652).

16. A method for verifying an adapted digital signature in an electronic message comprising:

receiving an electronic message from a remote sender;

retrieving an originator key (610) based on a first portion of said electronic message, said first portion of said electronic message comprising receiver address information;

generating an adapted digital signature (652), said act of generating comprising:

creating a digital signature (624) based on at least said originator key (610) and a second portion of said electronic message, said second portion of said electronic message comprising remote sender address information (616);

retrieving a word (656) from a word list (636), said word (656) corresponding to said digital signature (624);

returning at least said word (656) as said adapted digital signature (652);

comparing a third portion of said electronic message to said adapted digital signature (652), said third portion of said electronic message also comprising receiver address information; and

accepting said electronic message if said third portion of said electronic message and said adapted digital signature (652) match.

17. The method of claim 16, further comprising:

testing to determine whether a local user (608) corresponding to said first portion of said electronic message employs authenticated message server services; and

accepting said electronic message if said local user (608) does not employ said authenticated message server services.

18. The method of claim 16, wherein said remote sender address information (616) includes a sender domain name and said receiver address information includes a local userid (608).

19. The method of claim 16, wherein said step of generating said adapted digital signature (652) comprises:

creating a modified digital signature from said digital signature (624), said modified digital signature created with a boolean function (628), and wherein said word (656) is retrieved from said word list (636) based upon said modified digital signature;

generating a number (660); and

appending said number (660) to said word (656).

20. The method of claim 16, wherein creating said digital signature (624) includes executing a one-way hash function (620), said one-way hash function (620) using at least said originator key (610), remote sender address information (616), and receiver address information, said one-way hash function (620) generating a hash value, said hash value being said digital signature (624).

21. A computer-readable medium having stored therein one or more sequences of instructions configured to cause one or more processors to perform the steps described in any of the above method claims.

22. An electronic message system (100) comprising:

a computer (108) configured to run an electronic message server application;

a router (112) coupled to said computer (108), said router (112) configured to forward a first electronic message from a local user (104), said first electronic message comprising a first authenticated electronic userid (644), and said router (112) further configured to receive a second electronic message from a remote user (132), said second electronic message comprising a second authenticated electronic userid (644); and

a computer program stored in a memory device coupled to said electronic message system (100), said computer program configured to cause said electronic message system (100) to generate said first authenticated electronic userid (644) for said first electronic message, said first authenticated electronic userid (644) having an adapted digital signature (652) and an originator identifier (608), and said computer program further configured to cause said electronic message system (100) to filter said second electronic message if said electronic message system (100) cannot re-generate said adapted digital signature (652), based in part on envelope information associated with said second electronic message, and match said re-generated adapted digital signature (652) with a portion of said second authenticated electronic userid (644).

23. The electronic message system (100) of claim 22, wherein said computer program is further configured to generate said adapted digital signature (652) by:

creating a digital signature (624), said digital signature (624) based on said originator key (610), said local userid (608), and remote user information (616);

retrieving a word (656) from a word list (636), said word (656) corresponding to at least a portion of said digital signature (624); and

returning at least said word (656) as said first or said second adapted digital signature (652).

24. The electronic message system (100) of claim 22, wherein said computer program is further configured to:

extract an originator identifier (608) from said envelope information associated with said second electronic message;

compare said originator identifier (608) to a list of local userids (604); and

reject said second electronic message if said originator identifier (608) does not match at least one local userid in said list of local userids (604).

25. An authenticated message server (116) configured to create and verify an authenticated electronic userid (644),

wherein creating said authenticated electronic userid (644) comprises:

receiving a request for said authenticated electronic userid (644);

retrieving an originator key (610), said originator key (610) corresponding to a local userid (608);

generating a first adapted digital signature (652), said first adapted digital signature (652) based on said originator key (610), said local userid (608), and one or more other identifiers;

concatenating said first adapted digital signature (652) with at least an originator identifier (608); and

returning a result of said step of concatenating as said authenticated electronic userid (644); and

wherein verifying said authenticated electronic userid (644) comprises:

receiving an electronic message from a remote user (132), said electronic message comprising said authenticated electronic userid (644);

extracting said originator identifier (608) and first adapted digital signature (652) from said authenticated electronic userid (644);

retrieving said originator key (610) based on said originator identifier (608);

generating a second adapted digital signature (652), said second adapted digital signature (652) based on said originator key (610), said originator identifier (608), and one or more other identifiers;

comparing said first adapted digital signature (652) to said second adapted digital signature (652);

accepting said electronic message from said remote user (132) if said first adapted digital signature (652) and said second adapted digital signature (652) match; and

rejecting said electronic message from said remote user (132) if said first adapted digital signature (652) and said second adapted digital signature (652) do not match.

26. The authenticated message server (116) of claim 25, wherein said acts of generating said first adapted digital signature (652) and said second adapted digital signature (652) comprises:

performing an encryption function using said originator key (610), said local userid (608), and remote user information (616) to form a digital signature (624); and

converting said digital signature (624) from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature (652).

27. The authenticated message server (116) of claim 25, wherein said act of generating said first adapted digital signature (652) and said second adapted digital signature (652) comprises:

performing a one-way hash function, using said originator key (610) and said local userid (608), and remote user information (616) as inputs, to form a digital signature (624); and

converting said digital signature (624) from a first digital format into a second digital format, said digital signature in said second digital format being said second adapted digital signature (652).

28. The authenticated message server (116) of claim 25, wherein said act of generating said adapted digital signature (652) further comprises the steps of:

creating a digital signature (624), said digital signature (624) based on at least said originator key (610), said local userid (608), and remote user information (616);

retrieving a word (656) from a word list (636), said word (656) corresponding to at least a portion of said digital signature (624); and

returning at least said word (656) as said first or said second adapted digital signature (652).

29. The authenticated message server (116) of claim 28, further configured to perform the acts of executing a boolean operation (628) on said digital signature (624) to create a modified digital signature, and wherein said word (656) is retrieved based upon said modified digital signature.

30. The authenticated message server (116) of claim 28, further configured to perform the acts of:

generating a number (660); and

appending said number (660) to said word (656) to form said first or said second adapted digital signature (652).

31. The authenticated message server (116) of claim 25, wherein said act of verifying said authenticated electronic userid (644) further comprises:

extracting said originator identifier (608) from said envelope information associated with said electronic message;

comparing said originator identifier (608) to a list of local userids (604); and

rejecting said electronic message if said originator identifier does not match at least one local userid in said list of local userids.

32. A electronic message system (200) comprising:

an authenticated message server (212), said authenticated message server (212) configured to filter an inbound electronic message if an authenticated

electronic userid (644) cannot be verified, said inbound electronic message including address information;

and a mail host (212) coupled to said authenticated message server (212); wherein said authenticated message server (212) is configured to filter said inbound electronic message by performing the acts of:

generating an adapted digital signature (652), said act of generating comprising:

creating a digital signature (624) based on at least an originator key (610) and a first portion of said address information;

retrieving a word (656) from a word list (636), said word (656) corresponding to said digital signature (624); and

returning said word (656) as at least a portion of said adapted digital signature (652);

comparing a second portion of address information to said adapted digital signature (652); and

rejecting said inbound electronic message if said second portion of said address information and said adapted digital signature (652) do not match.

33. The electronic message system (200) of claim 32, wherein said authenticated message server (212) is configured to perform the act of parsing sender information and receiver information from said address information, said receiver information including an originator identifier (608), a second adapted digital signature (652), and said sender information including remote user information (616).

34. The electronic message system (200) of claim 32, wherein creating said digital signature (624) includes executing a one-way hash function (620), said one-way hash function (620) using at least said originator key (610) and a portion of said address information, said one-way hash function (620) generating a hash value, and said hash value being said digital signature (624).

35. The electronic message system (200) of claim 32, wherein said act of generating said adapted digital signature (652) further comprises performing a boolean function (628) on said

digital signature (624) to create a modified digital signature, and wherein said word (656) is retrieved based on said modified digital signature.

36. The electronic message system (200) of claim 32, wherein said authenticated message server (212) is further configured to perform the acts of:

generating a number (660); and

appending said number (660) to said word (656) to form said adapted digital signature (652).

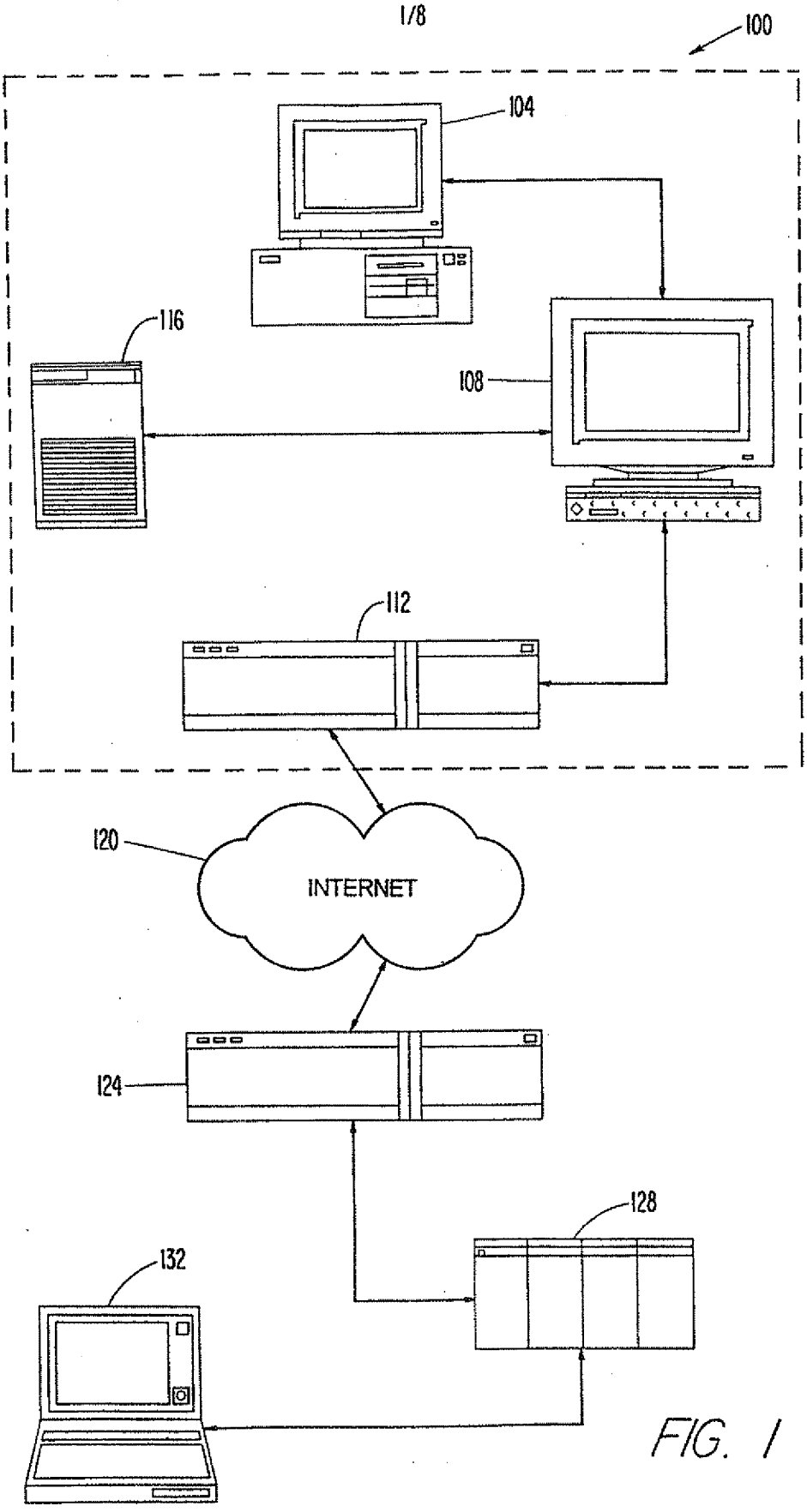



FIG. 1

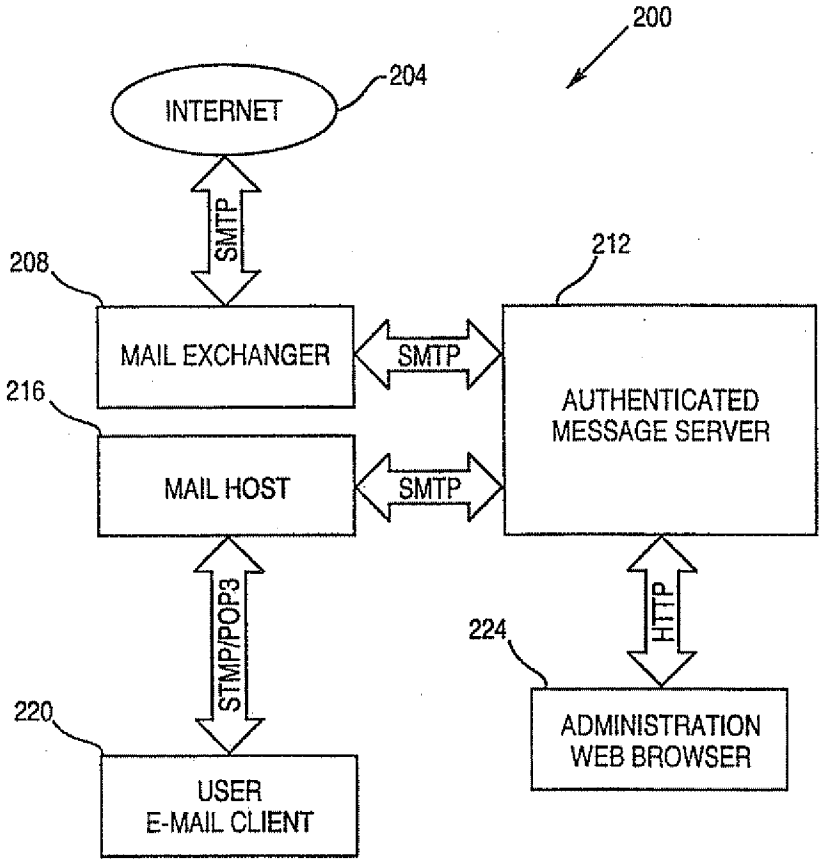

200
INTERNET
204
SMTP
208
212
MAIL EXCHANGER
SMTP
AUTHENTICATED
MESSAGE SERVER
216
MAIL HOST
SMTP
STMP/POP3
HTTP
224
220
ADMINISTRATION
WEB BROWSER
USER
E-MAIL CLIENT

FIG. 2

FIG. 3.

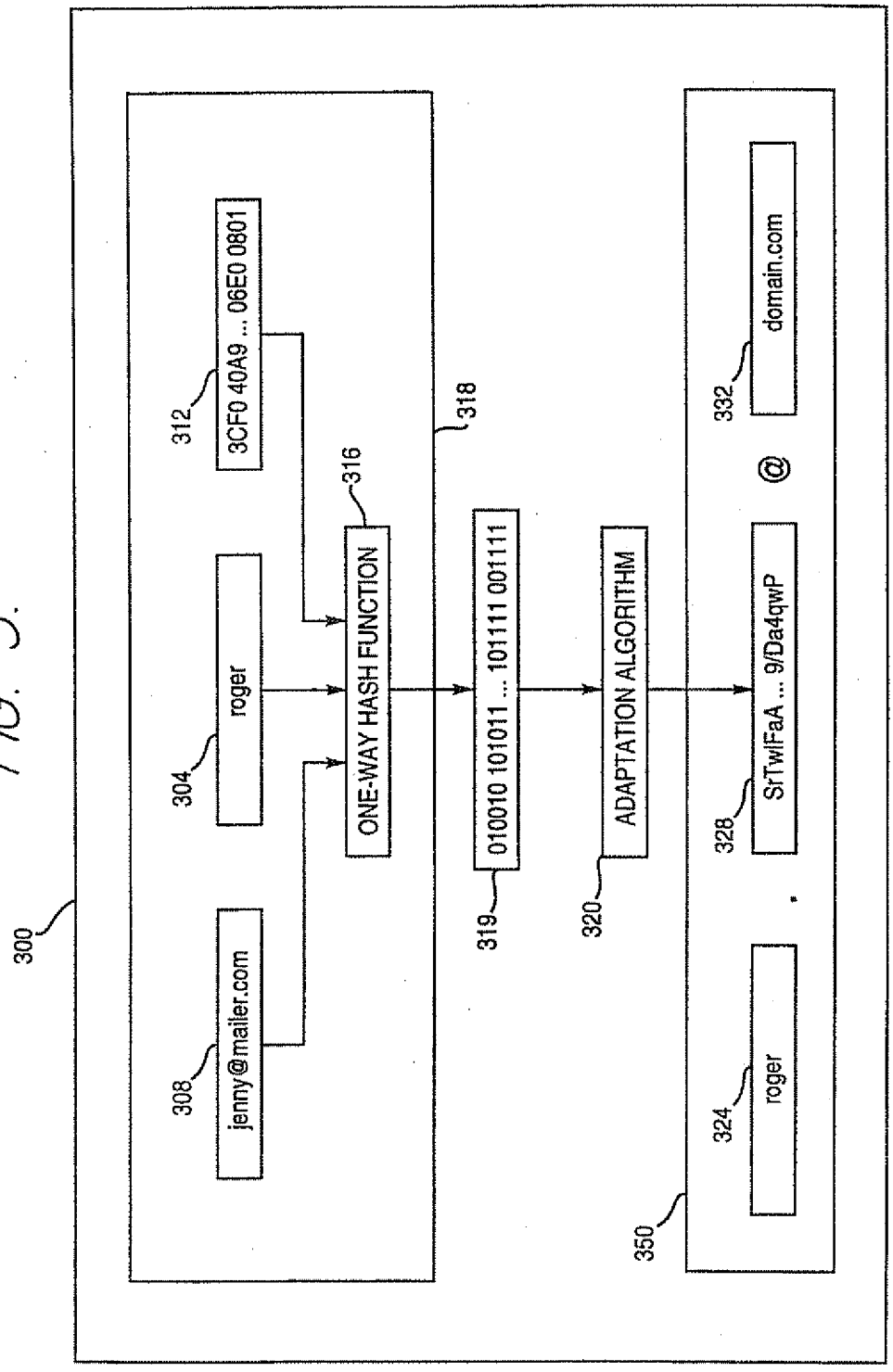
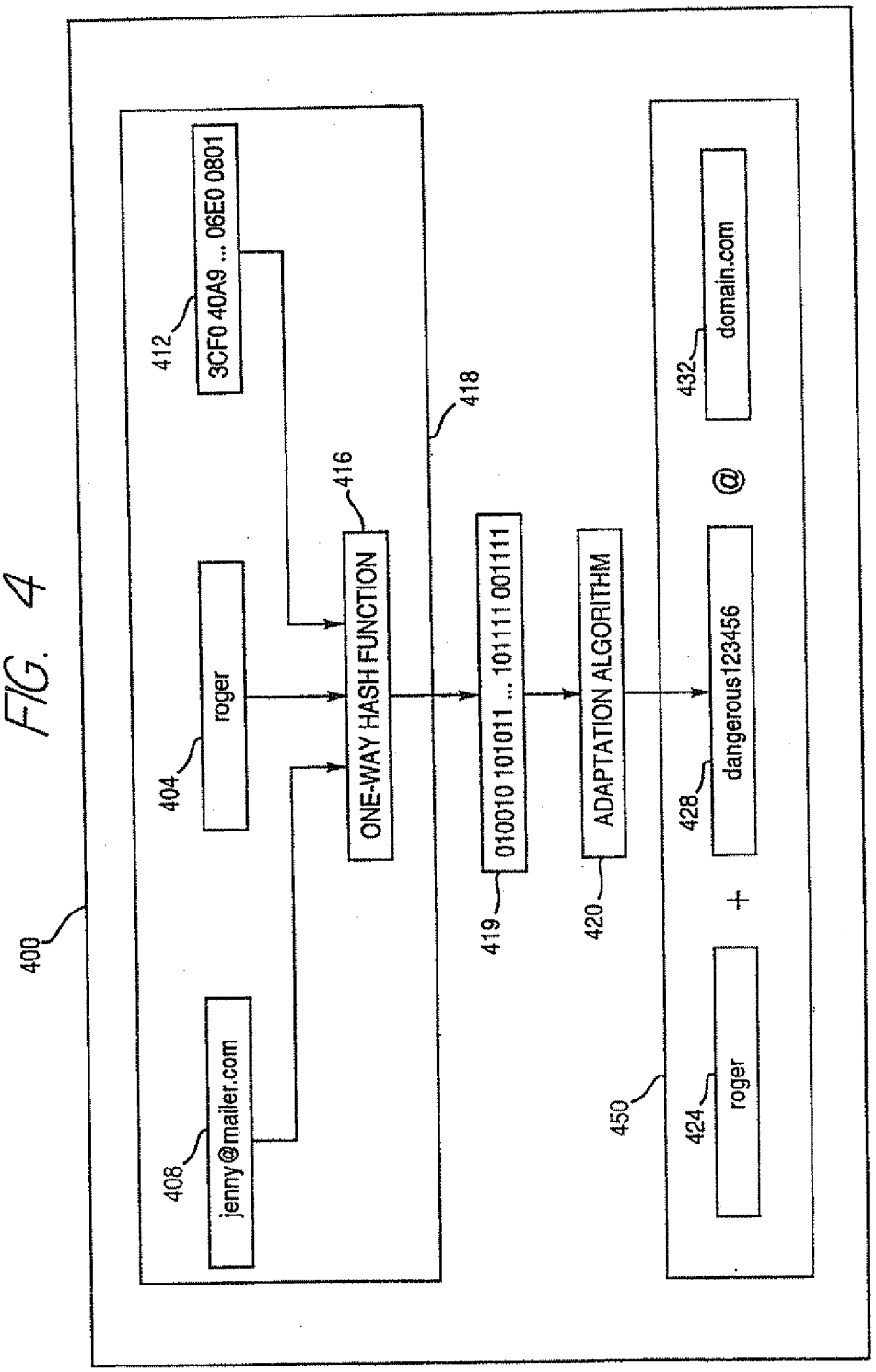

300
jenny@mailer.com
308
roger
304
3CF0 40A9 ... 06E0 0801
312
316
ONE-WAY HASH FUNCTION
318
010010 101011 ... 101111 001111
319
ADAPTATION ALGORITHM
320
SrTwIFaA ... 9/Da4qwP
328
@
domain.com
332
roger
324
350

FIG. 4


400
408
jenny@mailer.com
404
roger
412
3CF0 40A9 ... 06E0 0801
416
ONE-WAY HASH FUNCTION
418
419
010010 101011 ... 101111 001111
420
ADAPTATION ALGORITHM
450
424
roger
+
428
dangerous123456
@
432
domain.com

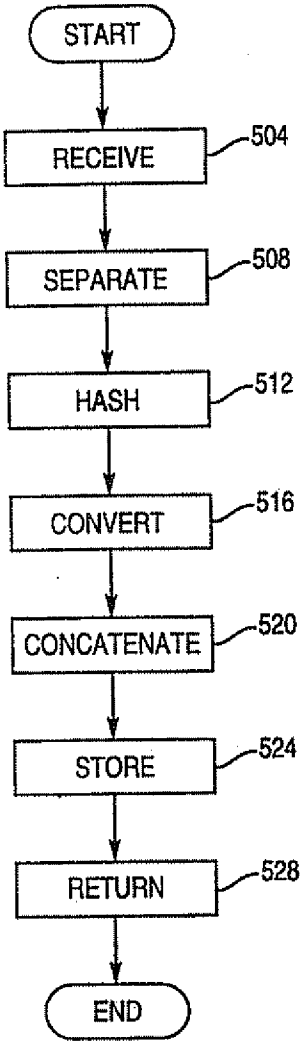

START
RECEIVE
504
SEPARATE
508
HASH
512
CONVERT
516
CONCATENATE
520
STORE
524
RETURN
528
END

FIG. 5

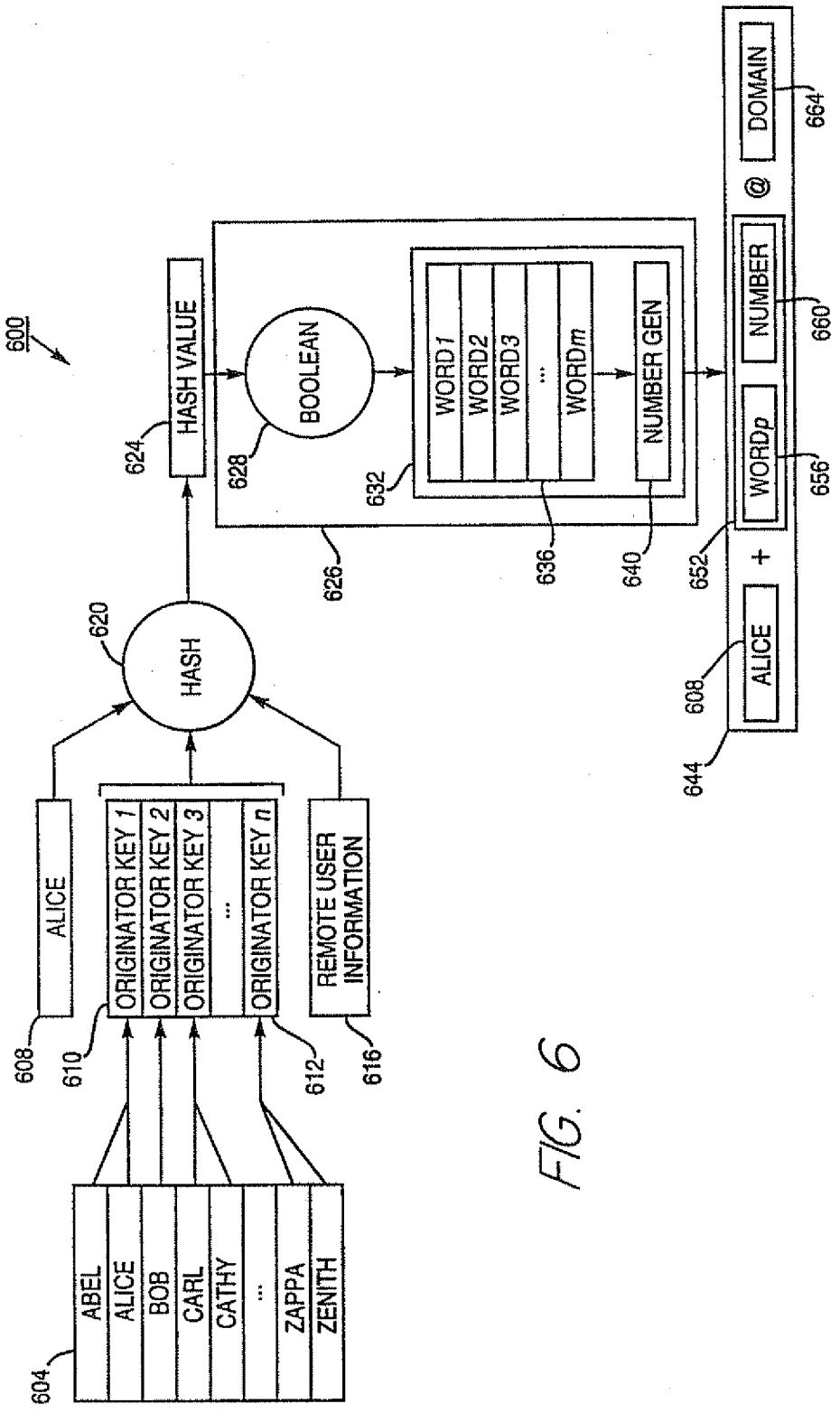

600
604
ABEL
ALICE
BOB
CARL
CATHY
...
ZAPPA
ZENITH
608
ALICE
610
ORIGINATOR KEY 1
ORIGINATOR KEY 2
ORIGINATOR KEY 3
...
ORIGINATOR KEY n
612
616
REMOTE USER INFORMATION
620
HASH
624
HASH VALUE
626
628
BOOLEAN
632
WORD1
WORD2
WORD3
...
WORDm
636
NUMBER GEN
640
644
ALICE
+
652
WORDp
656
NUMBER
660
@
DOMAIN
664

FIG. 6

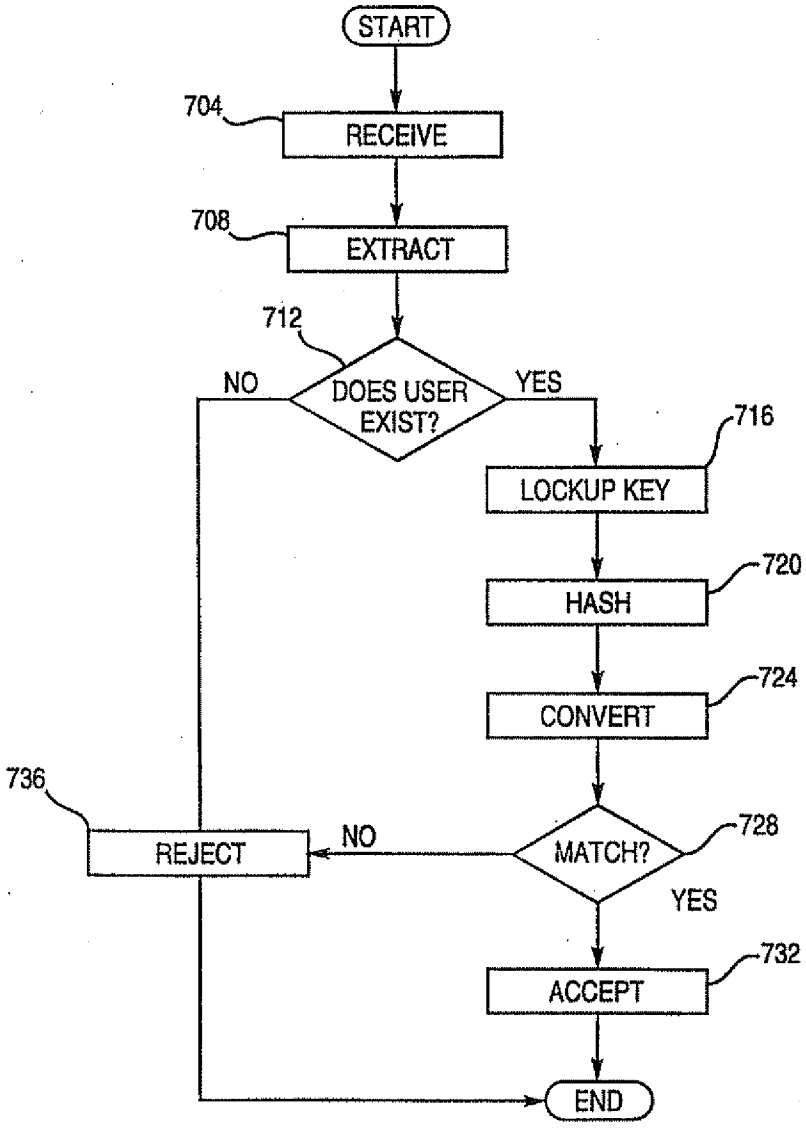

START
704
RECEIVE
708
EXTRACT
712
DOES USER EXIST?
NO
YES
716
LOCKUP KEY
720
HASH
724
CONVERT
728
MATCH?
NO
YES
736
REJECT
732
ACCEPT
END

FIG. 7

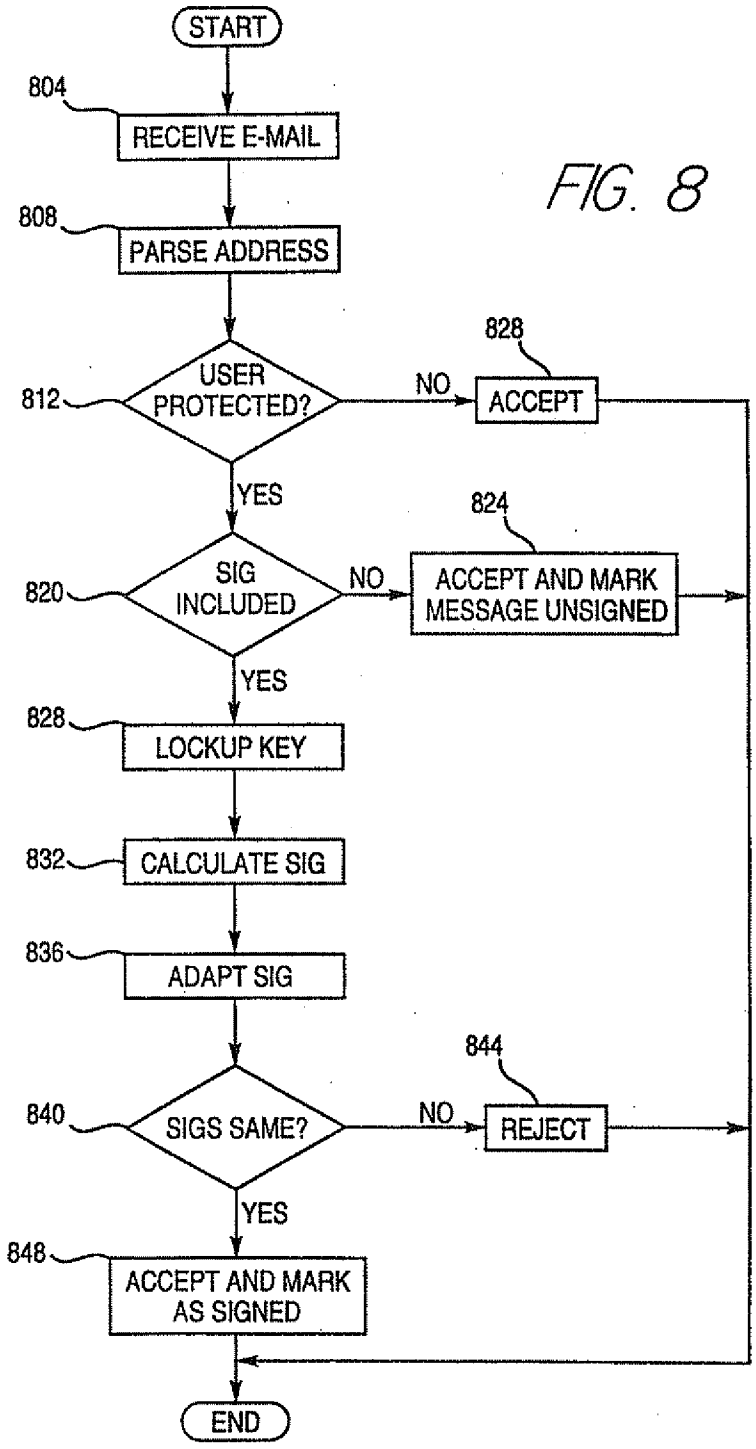

START
804
RECEIVE E-MAIL
808
PARSE ADDRESS
812
USER PROTECTED?
NO
828
ACCEPT
YES
820
SIG INCLUDED
NO
824
ACCEPT AND MARK MESSAGE UNSIGNED
YES
828
LOCKUP KEY
832
CALCULATE SIG
836
ADAPT SIG
840
SIGS SAME?
NO
844
REJECT
YES
848
ACCEPT AND MARK AS SIGNED
END

FIG. 8

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/17285

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) : H04L 9/32
US CL : 380/25, 49; 7O9/206
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 380/23, 25, 28, 49; 7O9/206; 713/200,201,202

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y, P | US 5,892,904 A (ATKINSON et al.) 06 April 1999 (06.04.1999), col.2 lines 44-52 | 1-49 |
| Y, E | US 5,943,426 A (FRITH et al.) 24 August 1999 (24.08.1999), abstract. | 44-49 |
| Y,P | US 5,867,578 A (BRICKELL et al.) 02 February 1999 (02.02.1999), abstract. | 1-49 |
| Y | US 5,754,659 A (SPRUNK et al.) 19 May 1998 (19.05.1998), abstract. | 1-49 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 24 September 1999 (24.09.1999) | 21 OCT 1999 |
| Name and mailing address of the ISA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br>Facsimile No. (703)305-3230 | Authorized officer<br>Dung Dinh for<br>Telephone No. 305 9600 |

Form PCT/ISA/210 (second sheet) (July 1998)